

Amendments to the Claims:

Claims 1-32 are pending in this application. Claims 1-32, as originally filed, are provided as follows:

- 1 1. (original) A virtual storage system comprising:
2 a computing device accessing virtual storage;
3 a plurality of physical storage devices; and
4 a controller in communication with the computing device and the
5 plurality of physical storage, the controller operative to
6 (a) receive a virtual storage access request from the computing
7 device specifying a virtual data access, the virtual data access
8 comprising a plurality of blocks, each of the plurality of blocks
9 associated with one of at least two target physical storage
10 devices, the target physical storage devices comprising at least
11 a subset of the plurality of physical storage devices;
12 (b) determine an access sequence associating one target storage
13 device with each block in the received virtual storage access
14 request;
15 (c) send at least one physical access request to each target storage
16 device;
17 (d) receive at least one error message from at least one target
18 storage device, each error message having an error type; and
19 (e) determine an error response based on the error message type
20 and on the access sequence.
- 1 2. (original) A virtual storage system as in claim 1 wherein received
2 error message types comprise communication error and access error.

1 3. (original) A virtual storage system as in claim 1 wherein the
2 determined error response comprises terminating the virtual storage access if the
3 received error type comprises a communication error.

1 4. (original) A virtual storage system as in claim 1 wherein the
2 determined error response comprises terminating each physical access request
3 corresponding to a block in the access sequence later then a problematic block, the
4 problematic block one of the plurality of blocks an attempted access of which
5 generates at least one error message.

1 5. (original) A virtual storage system as in claim 4 wherein the
2 virtual storage access comprises a read operation from the computing device, the
3 controller returning to the computing device blocks in the access sequence prior to
4 the problematic block.

1 6. (original) A virtual storage system as in claim 1 wherein the
2 determined error response comprises terminating each physical access request
3 corresponding to a block in the access sequence later then a problematic block, the
4 problematic block one of the plurality of blocks an attempted access of which
5 generates a communication error.

1 7. (original) A virtual storage system as in claim 6 further comprising
2 returning an indication of an access error to the computing device.

1 8. (original) A virtual storage system as in claim 1 wherein the
2 determined error response comprises terminating each physical access request
3 corresponding to a block in the access sequence later then a problematic block, the
4 problematic block one of the plurality of blocks an attempted access of which
5 generates an access error.

1 9. (original) A virtual storage system as in claim 1 wherein the error
2 response includes an indication of the first block in the access sequence the access of
3 which generates an error message.

1 10. (original) A method of servicing a virtual storage request placed
2 by a computing device, the virtual storage request specifying a plurality of blocks,
3 the blocks distributed between at least two physical target storage devices, the method
4 comprising:
5 determining an access sequence associating one target storage device
6 with each block in the virtual storage request;
7 sending at least one physical access request to each target storage
8 device;
9 receiving at least one error message, each error message sent from one
10 target storage device, each error message having one of a plurality of error types; and
11 determining an error response based on the error type for at least one
12 error message and on the access sequence.

1 11. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein the error types comprise a communication error and an access
3 error.

1 12. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein the error message has a communication error type indicating the
3 target storage device sending the error message is unavailable, the error response
4 comprising terminating each physical access request for all target storage devices.

1 13. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein the error message has an access error type indicating the target
3 storage device cannot access a problematic block, the error response comprising

4 terminating each physical access request for any block in the access sequence after
5 the problematic block.

1 14. (original) A method of servicing a virtual storage request as in
2 claim 13 wherein the virtual storage request is a read request, the error response
3 further comprising sending to the computing device all blocks in the access sequence
4 before the problematic block.

1 15. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein the error message has a communications error type, the error
3 response comprising terminating each physical access request for any block in the
4 access sequence after the problematic block.

1 16. (original) A method of servicing a virtual storage request as in
2 claim 15 wherein the virtual storage request is a read request, the error response
3 further comprising sending to the computing device all blocks in the access sequence
4 before the problematic block.

1 17. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein determining an error response comprises:
3 determining a first problematic block in the access sequence as the first
4 occurring block in the access sequence the attempted access of which returned an
5 error message; and
6 returning an indication of the first problematic block to the computing
7 device placing the virtual storage request.

1 18. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein determining an error response comprises:
3 determining as a first problematic block the first block in the access
4 sequence the access attempt of which generated an error message;

5 determining the error type for the first problematic block; and
6 forwarding the determined error type to the computing device placing
7 the virtual storage request.

1 19. (original) A method of servicing a virtual storage request as in
2 claim 10 wherein determining an error response comprises:

3 determining as a first problematic block the first block in the access
4 sequence the access attempt of which generated an error message;

5 determining the error type for the first problematic block as a
6 communication error; and

7 forwarding an access error type message to the computing device
8 placing the virtual storage request.

1 20. (original) A method of servicing a virtual storage request placed
2 to a virtual storage device, the virtual storage request comprising a logical sequence
3 of a plurality of blocks stored on a plurality of physical storage devices, the physical
4 storage devices comprising the virtual storage device, the method comprising:

5 placing at least one physical storage request to each of the plurality of
6 physical storage devices, each physical storage request requesting access to at least
7 one of the plurality of blocks stored on the physical storage device targeted by the
8 physical storage request;

9 receiving a response from each targeted physical storage device
10 corresponding to each physical storage request, each response comprising a
11 successful response or an error response, the error response indicating an error type;

12 for each error response, determining if the error type is an access
13 error, the access error indicating the targeted physical storage device could not access
14 a problematic block, the problematic block requested in the corresponding physical
15 storage request; and

16 if the error type is an access error, canceling all active physical storage
17 requests later in the logical sequence than the problematic block.

1 21. (original) A method of servicing a virtual storage request as in
2 claim 20 further comprising canceling all active physical storage requests if the error
3 type is a communication error indicating the targeted physical storage device
4 receiving the corresponding physical storage request is unavailable.

1 22. (original) A method of servicing a virtual storage request as in
2 claim 20 further comprising canceling any active physical storage requests later in the
3 logical sequence then the problematic block if the error type is a communication error
4 indicating the targeted physical storage device receiving the corresponding physical
5 storage request is unavailable.

1 23. (original) A method of servicing a virtual storage request as in
2 claim 20 wherein the virtual storage request comprises a read request, the method
3 further comprising forwarding to a computing device placing the virtual storage
4 request all blocks in the logical sequence prior to the problematic block.

1 24. (original) A method of servicing a virtual storage request as in
2 claim 20 further comprising returning an error indication comprising an indication
3 of a first problematic block, the first problematic block being the first block in the
4 logical sequence the access of which generates an error response.

1 25. (original) A virtual storage system comprising:
2 a plurality of physical storage devices, each physical storage device
3 storing information as a plurality of blocks, each physical storage device responding
4 to a failed physical access request with an error message having one of a plurality of
5 error types; and

6 a controller responding to a virtual storage request for a sequence of
7 blocks stored on at least two of the physical storage devices, the controller operative
8 to

- 9 (a) determine an access sequence associating one physical storage
10 device with each block in the virtual storage request,
- 11 (b) send at least one physical access request to each physical
12 storage device listed in the access sequence,
- 13 (c) receive at least one error message from at least one of the
14 physical storage devices in the access sequence, and
- 15 (d) determine an error response based on the error type for at least
16 one error message and on the access sequence.

1 26. (original) A virtual storage system as in claim 25 wherein the
2 error types comprise a communication error and an access error.

1 27. (original) A virtual storage system as in claim 25 wherein at least
2 one received error message has a communication error type, each physical access
3 request for all physical storage devices in the access sequence terminated by the
4 controller.

1 28. (original) A virtual storage system as in claim 25 wherein a
2 received error message has an access error type indicating the physical storage device
3 sending the received error message cannot access a problematic block, each physical
4 access request for any block in the access sequence after the problematic block
5 terminated by the controller.

1 29. (original) A virtual storage system as in claim 28 wherein the
2 virtual storage request comprises a read request, the controller further returning all
3 blocks in the access sequence before the problematic block in response to the virtual
4 storage request.

1 30. (original) A virtual storage system as in claim 25 wherein a
2 received error message has a communication error type, each physical access request
3 for any block in the access sequence after the problematic block terminated by the
4 controller.

1 31. (original) A virtual storage system as in claim 30 wherein the
2 virtual storage request comprises a read request, the controller further returning all
3 blocks in the access sequence before the problematic block in response to the virtual
4 storage request.

1 32. (original) A virtual storage controller for servicing a virtual
2 storage request placed to a virtual storage device, the virtual storage request
3 comprising a logical sequence of a plurality of blocks stored on a plurality of physical
4 storage devices, the virtual storage controller cancelling any requests to access blocks
5 later in the logical sequence than a problematic block the access of which generated
6 an access error, the virtual storage controller cancelling all requests to access blocks
7 after receiving a communication error from any physical storage device.